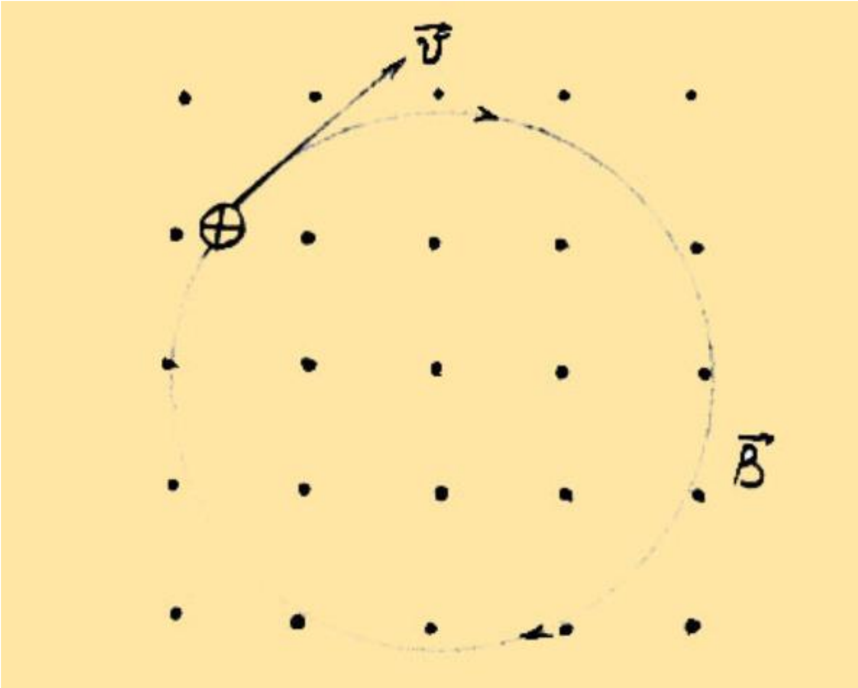
An electron of mass 9.1 x 10^-31 kilograms inside a special vacuum chamber at Caltech undergoes acceleration of 3 x 10^4 m/sec^2 caused by an electrostatic force. Determine the force applied to the electron.

Solution:



Consider the special case where there is no electric field, but there is a magnetic field. Assume that a particle having an initial velocity u0, enters the magnetic field of B. This field will be assumed to be uniform and directed perpendicular to the velocity u0.

Basic features of the motion in this case, you can find out without resorting to a full solution of equations of motion. First of all, it should be noted that on the particle Lorentz force is always perpendicular to the velocity of the particle. This means that the work of the Lorentz force always equal to zero, therefore, the absolute value of particle velocity, and hence energy of the particles remains constant during the motion. Since the particle velocity u is not changed, the magnitude of the Lorentz force

$$\vec{F}_L = e\vec{v}_e\vec{B}$$

remains constant. This force, being perpendicular to the direction of movement is centripetally

$$ma = \frac{mv^2}{r} = evB = 9.11 * 10^{-31} \cdot 3 \cdot 10^4 = 2.733 \cdot 10^{-26}N$$

Answer: $2.733 \cdot 10^{-26}N$